Animal & Plant Health Agency

SRUC

GB small ruminant quarterly report

Disease surveillance and emerging threats

Volume 23: Q1 – January - March 2020

Highlights

- **Suspected adverse reaction to erysipelas vaccine in sheep – page 5**
- **Chiari type II malformation and spina bifida in a lamb – page 6**
- **Summary of reproductive cases Q1 2020 – page 15**

Contents

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Introduction and overview

This quarterly report reviews disease trends and disease threats for the first quarter of 2020, January to March. It contains analyses carried out on disease data gathered from APHA, SRUC Veterinary Services division of Scotland's Rural College (SRUC) and partner post mortem providers and intelligence gathered through the Small Ruminant Species Expert networks. In addition, links to other sources of information including reports from other parts of the APHA and Defra agencies are included. A full explanation of how data is analysed is provided in the annexe available on GOV.UK https://www.gov.uk/government/publications/information-on-data-analysis

Issues & Trends

On 23rd March 2020 the Prime Minister announced that the UK would be placed in "lockdown" due to the global Covid-19 pandemic. This required all non-essential workers to stay at home and social distancing measure that required people to keep a distance of 2 metres from each other. Farmers and veterinarians were identified as key workers but the social distancing rule impacted on the way veterinary services could be delivered and risk assessments were applied to consider what activities could continue safely. Welfare of animals was key and many essential tasks continued, for example assistance during lambing. However routine work considered as non-essential ceased, for example routine flock health blood sampling, where social distancing was impossible.

SRUC suspended testing for sheep and goats under the Premium Sheep & Goat Health Scheme as it was deemed impossible to practice social distancing while blood sampling sheep for the purpose of monitoring flock status under the Health Schemes. Flock status will not be affected.
https://www.sruc.ac.uk/news/article/2628/sheep_and_goat_health_scheme

Concerns were raised over potential welfare issues (blowfly strike) arising this summer if sheep are not clipped due to the lack of availability of shearers. Many shearers come to work in the UK from overseas but travel is likely to be limited due to Covid-19. The National Association of Agricultural Contractors created a shearers database to assist contractors in putting together UK teams to ensure that the flock gets shorn to prevent unnecessary animal welfare problems: https://www.naac.co.uk/jobs/shearingregister/

APHA took all reasonable preventative measures in view of the current Covid-19 situation and developed contingency plans in place to manage services across the network during the outbreak. APHA continues to provide a diagnostic service for livestock through carcases submitted for post mortem examination and from samples submitted by post for diagnostic testing and vets were reminded to contact their local site as directed by the postcode finder: http://apha.defra.gov.uk/postcode/pme.asp

The contingency plans enabled continued provision of post mortem services across our network of Veterinary Investigation Centres (VICs) and partner providers. In the event of a post mortem site (either APHA VICs or one of our partner provider sites) being unable to

receive carcase material due to staff being unavailable, APHA will make arrangements to transport carcases to an alternative site using the free carcase collection service.

Submissions to all laboratories have been reduced as a consequence of restrictions but APHA has continued to receive abortion submissions throughout the lambing period. Abortion submissions have reduced in Q1 2020 (436) compared to Q1 2019 (626).

Weather

The winter was notably milder than average, and broadly unsettled, though with a few interludes of quieter weather. February was particularly wet and stormy, and included three named storms, with widespread high rainfall totals and associated impacts. Frosts were fewer than average, and, although there were some snowfalls in certain areas, these were of limited severity. Overall this was the fifth mildest winter in a series from 1884, and the fifth wettest since 1862. Such factors, especially the increasing mean temperature, have the potential to influence endemic disease impact - for example, the survival of endoparasite larvae overwintering on pasture.

APHA published a Focus article to raise awareness of potential medium (once flood waters have receded) and longer-term (when land and buildings have come back into use) livestock endemic disease risks associated with flooding events in Great Britain (2020).

https://veterinaryrecord.bmj.com/content/186/9/275.full?ijkey=5cgMW.N/Z7FOg&keytype=ref&siteid=bmjjournals

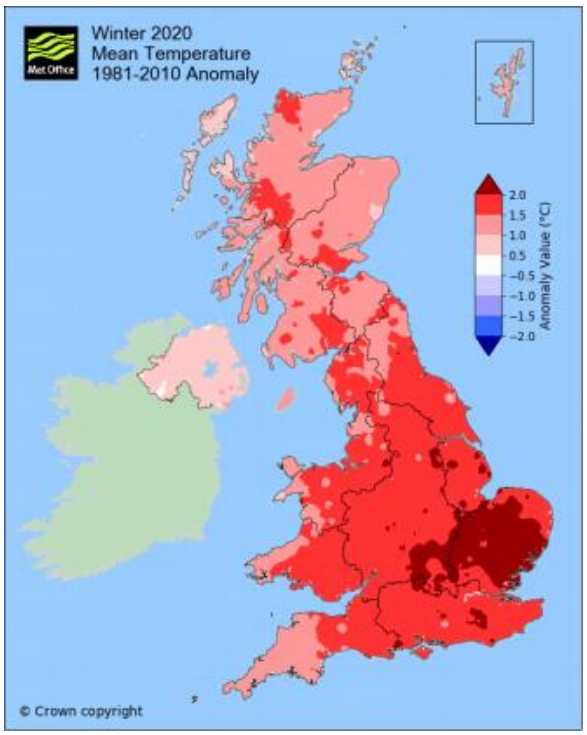

Figure 1 Winter 2020 mean temperature anomaly compared to 1981-2010 expressed as % of the average for 1981-2010

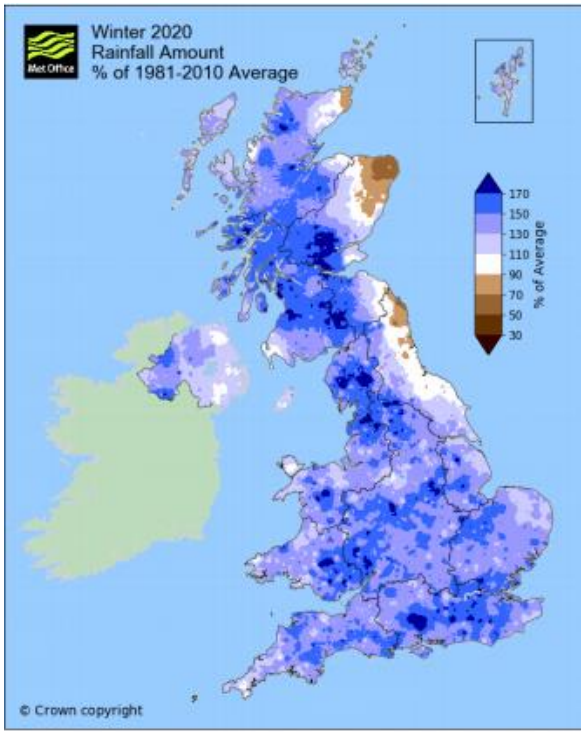

Figure 2 Actual rainfall amount % of average 1981 -2010

Industry

The UK sheep market was largely buoyant during quarter one 2020, although there was a definite change of pace in the middle of March. Prior to the middle of March prices were

trending high, at record breaking levels for the time of year. Supplies of sheep meat were relatively tight, supporting prices.

Come the middle of March, Covid-19 caused a sharp shift. Over the weekend of the 21–23 March, live weight lamb prices dropped by the equivalent of £30/head. As France began to enter lockdown demand there dropped. The UK was then put into lockdown and while there was a short-term surge in demand as consumers panic bought food; since then total demand has been down. Although there has been a rise in demand at retail, this has not been enough to offset the loss of the foodservice market.

Production during quarter one totalled 66,000 tonnes, down 5,000 tonnes on-the-year. Lamb kill was down, although this was expected considering the reduced size of the 2019 lamb crop.

Rebecca Wright, AHDB

New and re-emerging diseases and threats

Unusual diagnoses

Suspected adverse reaction to erysipelas vaccine in sheep

In a lowland flock of mixed age crossbred ewes, lameness due to erysipelas had been diagnosed in a previous lamb crop. In January 2020, to protect the current lamb crop against erysipelas and following cascade principles, ewes were administered porcine erysipelas vaccine (2ml intramuscularly) six to seven weeks prior to the start of lambing. A group of 400 triplet-bearing ewes were vaccinated on one day and a further 600 twin-bearing ewes were vaccinated the following day. In the 24–48 hours after vaccination, 10 ewes from the triplet-bearing group presented with signs of malaise that were attributed to hypocalcaemia. They were subsequently treated with calcium, multivitamins and meloxicam. Of the 10 sheep, three died and seven recovered. Two other sheep in this group aborted.

In the twin-bearing group, two sheep were found dead the day after vaccination and a further 12 showed signs of severe lethargy and anorexia but recovered. Within 48 hours of vaccination, two further sheep died and 18 aborted. Approximately half of the ewes in both groups showed milder signs of lethargy and inappetance 24 hours after vaccination with some mild respiratory signs observed within 24–48 hours. The majority of ewes were fully recovered 36 hours after vaccination. One week post vaccination there had been eight ewe deaths and 40 abortions in the total vaccinated group of 1000 ewes. By the last pre-lambing week, 150 ewes (15%) had aborted. A further 100 ewes lambed to term producing at least one mummified foetus of a size indicating foetal death around the time of erysipelas vaccination. Over the same time period in a group of 1300 ewes with the same management which did not receive Porcilis® Ery vaccine, abortions were at less than 1%.

The ewes had received a first dose of vaccination for clostridial disease two to three weeks prior to the incident. Sheep entering the flock at 18 months of age were vaccinated against enzootic abortion, toxoplasmosis and campylobacter abortion and in December 2019 all ewes were vaccinated against footrot.

Three ewes (aged three years or more) and two sets of aborted triplets were submitted for post mortem examination. Standard testing for abortifacients on the foetuses showed no evidence of bacterial causes or toxoplasmosis.

The lungs of all of the ewes were diffusely dark red with a rubbery texture. Microscopically there was pulmonary congestion, and oedema; one ewe had disseminated intravascular coagulation. No bacterial pathogens were cultured from the lungs. In conjunction with the clinical history an anaphylactoid reaction to erysipelas vaccine was deemed a plausible explanation for the lung lesions. The abortions were attributed to the suspected adverse reaction and a report was submitted to the VMD.

The clinical history and pathology in this case are similar to those seen following the use of Moxidectin1% injection for sheep (moxidectin) that have previously been vaccinated against footrot. Clinical signs include dyspnoea, ataxia, depression, death and abortions. Moxidectin 1% has a contraindication for use in animals with a history of previous vaccination against footrot. It is postulated that the presence of polysorbate 80 (PS-80), an excipient in Moxidectin 1% and the mineral oil base of Footrot vaccine, produces a non-immunological anaphylactoid reaction. Similar unpublished reactions are reported in South American cattle receiving Moxidectin containing PS-80 and foot-and-mouth vaccine with a mineral oil base.[1] PS-80 (Tween® 80) has induced severe non-immunological anaphylactoid reactions in humans as an uncommon event, and is also a component of the particular porcine erysipelas vaccine. There have been a small number (one other in 2020) of previous adverse reaction reports made to VMD following the use of porcine erysipelas vaccine in sheep. The pharmacodynamics of constituents of porcine erysipelas vaccine in sheep either alone or in combination with other products are unknown. If sheep are reacting to PS-80 alone this would suggest they are more sensitive to it than other species in which it is widely used.

Since 2009 there have been no vaccines authorised in the UK to control erysipelas in sheep. Subsequently, erysipelas vaccines authorised for use in other species have been used in sheep following cascade principles.

While there is no proven link between anaphylaxis and the use of these porcine vaccines in sheep, veterinary surgeons should be cautious when prescribing unauthorised vaccines in sheep and determine whether footrot vaccines have been previously administered. In addition, veterinary surgeons are reminded to report any suspected adverse reactions to the VMD (https://www.gov.uk/report-veterinary-medicine-problem).

Chiari type II malformation and spina bifida in a lamb

A single full term lamb in a flock of 100 Texel ewes was born alive with arthrogryposis of the hind legs in an assisted lambing by the farmer. It was euthanased by the submitting vet

soon after. From the 30 ewes which had lambed by that time, no other similar lambs had been seen and there had been no concerns regarding abortions.

The ewes had been housed for over one month, being fed haylage and concentrates. Prior to this they had been at pasture. There was no illness reported in the dam and ewe condition was generally good. Replacement ewes are homebred whilst tups were purchased.

At post mortem examination, multiple developmental abnormalities were found, primarily involving the central nervous system including arthrogryposis of the hind legs with a limited range of movement in all the joints. In the skin over the caudal lumbar spine there was a diamond shaped defect, exposing pink subcutaneous tissues. On dissection through the subcutaneous tissues, it became apparent that there was deviation of the spinal cord out of the spinal canal dorsally where it branched into the cauda-equina (Figure 3). There was asymmetric narrowing and elongation of the right occipital cortex which was partially overriding the cerebellum and displacing the cerebellum caudally (Figure 4). The spinal column twisted along its length by around 90° (Figure 5) and the vertebrae at the cranial aspect of the pelvis did not have a visible canal.

Both kidneys had thin cortices with the renal pelvises being filled with clear urine; the bladder was also distended.

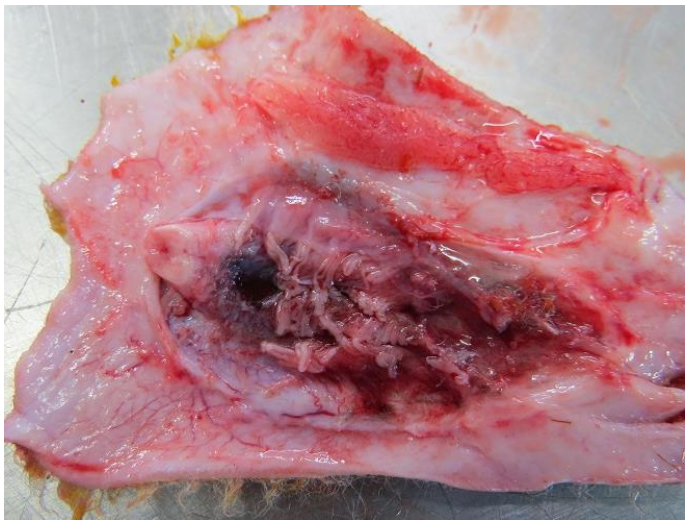

Figure 3 Lumbar spine – cauda equina

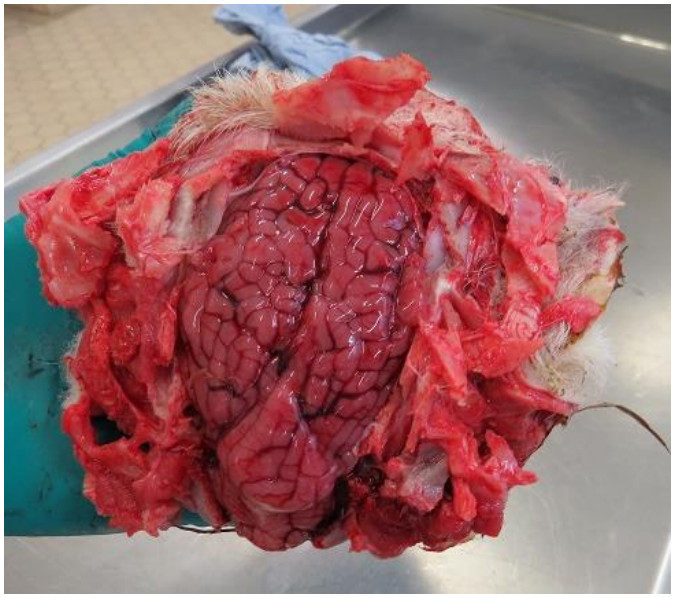

Figure 4 Displaced cerebellum (right side)

Figure 5 Twisted vertebral column

Neither Schmallenberg virus nor Border disease virus were detected with PCR testing.

Histopathology determined that the spinal cord was dysplastic and with loss of epithelium, subcutis and elements of the spinal canal and dura mater, such that the spinal cord was in contact with the skin surface. Within the dysplastic spinal cord tissues, there were symmetrical bodies of large motor neurones (ventral horns) and discernible nerve roots but the neuraxis merged with the surrounding soft tissues. The kidneys had marked distension of the pelvis and compression of the renal parenchyma but no abnormalities in the architecture.

This constellation of congenital abnormalities were considered to be related. There was Chiari type II malformation, spina bifida and hydro nephrosis. Chiari type II (also called

Arnold-Chiari) malformation involves defective neurogenic induction of osteogenesis in the caudal fossa, leading to a reduced size of the occipital cavity and herniation of the cerebellum and occipital cortices through the foramen magnum. Spina bifida is occasionally observed concurrently with this condition and in itself is a failure of closure of the neural tube at the caudal extent. The disruption to normal neural development in this part of the spinal cord will have resulted in the hind limb arthrogryposis, impaired bladder function and consequent hydronephrosis. This is considered a sporadic event and rare in sheep. In humans, it is considered some such congenital malformations may be the result of genetic mutations.

Osteogenesis Imperfecta in a lamb

Osteogenesis imperfecta (OI) was diagnosed in a five-day-old Valais Blacknose lamb which was born to a shearling (approximately two-year-old) ewe that lambed outside unassisted. The ewe was reported to be in good condition, at grass, and fed on additional coarse mix for the previous four weeks. The lamb was noticed to have broken hind legs soon after birth. It received veterinary attention, including the application of casts to both hind legs. It was kept inside following this, with bottle feeding every four hours, with colostrum from its dam for the first two days. This lamb had limited mobility due to the casts; however, four days later, the lamb was found to have a broken front leg which was splinted by the owner. There was no known trauma. The lamb (Figure 6) was euthanased by the private vet, prior to submission for post mortem examination (PME).

At PME the left and right mandible bones broke with minimal manipulation and the ribs and sternum and the dorsal third of both scapulae were soft and flexible on minimal manipulation. There were fractures in all four limbs - all full bone fractures, all non-displaced bones with no significant gross bone healing evident at this stage (Figure 7). The cortices of the diaphyses of the limb bones were variable, some quite thin - 0.1 cm depth. The joints and skeletal muscles were unremarkable.

Figure 6 Valais Blacknose lamb with casts removed.

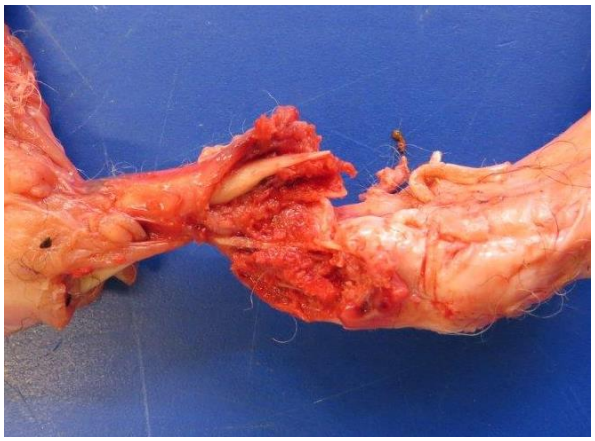

Figure 7 Distal radius oblique diaphysis fracture

In addition the spiral colon comprised a firm mass of reddened tissue, with serosal abscesses, fibrinous adhesions and thickening and reddening of the mucosa. There were no other alimentary tract lesions. There were mucoid liquid brown faeces within the colon and rectum. *Salmonellae, Cryptosporidium* sp, Rotavirus, Border disease virus (and BVD virus) were not detected in this lamb. *Escherichia coli* (not K99) was detected in the colon mass and large intestine contents, and may have played a role in the colitis.

Histopathological examination of the long bones in this lamb indicated abnormal development of bone indicating osteogenesis imperfecta. The spiral colon showed extensive ulceration and transmural inflammation and infection with bacteria. Entero-invasive *E. coli* infection was a differential.

Osteogenesis imperfecta (OI) is a group of inherited connective tissue disorders caused by genetic mutations leading to connective tissue disorders characterised by reduced bone content and increased skeletal fragility, thereby increasing the likelihood of bone fractures. Although bones are of normal length, they can break or fracture easily due to low bone density. Once an injury occurs, healing can be slow or incomplete. In addition, joint laxity, scoliosis, kyphosis, dentinogenesis imperfecta as well as craniofacial abnormalities may represent concomitant phenomena in OI although none of these abnormalities were present in the submitted lamb.

OI has been reported in humans (brittle bone disease), cattle, sheep, cats and dogs. In humans, more than 90% of OI cases are caused by autosomal dominant mutations in the genes encoding type I collagen. In cattle a possible oligogenic origin of the disease has been described (Zhang and others 2020), while in sheep a study of New Zealand Romney (Arthur and others 1992) described dominant mutations in the germ cell line of the sire which resulted in the disease manifesting in 30% of the offspring while the ram was clinically normal.

It was suspected this lamb was a sporadic isolated case of OI. As in the New Zealand Romney it is likely that this was due to a mutation occurring in germ cell lines within the testes of an individual ram. Recessive mutations will usually remain concealed unless a

carrier sire is used excessively or there is inbreeding, while defective dominant genes will become manifest in up to 50% of the ram's offspring.

The definitive cause of the spiral colon pathology was not determined and may be totally unrelated to the OI. It is possible there may have been a regional connective tissue defect which may have compromised colon integrity (with / without trauma) leading to the transmural colitis. Both isolates of *Escherichia coli* showed *in vitro* resistance to tetracyclines on antimicrobial sensitivity testing. The large intestine isolate was tested further and showed *in vitro* resistance to neomycin and streptomycin. It was advised that the antimicrobial sensitivity patterns may be important in relation to potential treatments of bacterial infections in neonatal lambs on this farm.

Changes in disease patterns and risk factors

Syndromic analysis

Most common diagnoses Q1 2020

During Q1 2020, 1723 diagnostic submissions were received in GB and the presenting signs of sheep and age category from which samples/carcases were submitted, with abortion the most common sign (Figure 8) and age group for submissions (Figure 9). Note that abortions are included in the adult category.

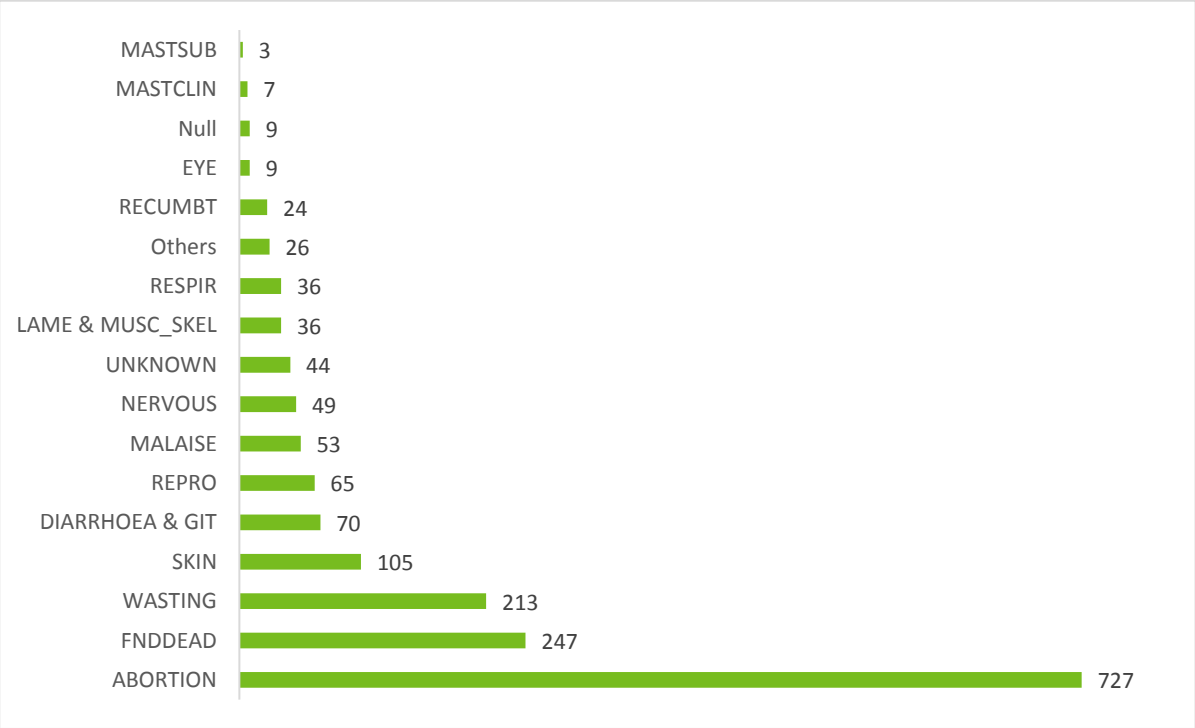

Figure 8 Presenting signs of sheep from GB submissions Jan - Mar 2020

Adult	1,016
Mixed	28
Neonatal	93
Post weaned	86
Preweaned	101
Unknown/other	399

Figure 9 Age group of submissions Q1 2020

Of the 727 abortion submissions during Q1 2020 a diagnosis was achieved in 420 cases. Where a diagnosis is not reached this may be due to inadequate or inappropriate samples to allow testing to achieve a diagnosis. The 420 cases where a diagnosis was reached are shown in the table Figure 10:

Abortion-Enzootic	177
Abortion-Toxoplasmosis	82
Abortion-Campylobacter	59
Abortion-Not listed	36
Abortion-Listeria	15
Border disease	8
Abortion-Salmonella	7
Abortion-Yersinia sp	7
Abortion-*Salmonella* Dublin	6
Abortion-T. pyogenes	5
Abortion-*Salmonella* Montevideo	3
Abortion-*Bacillus licheniformis*	2
Congenital abnormality	2
Abortion-fungi	1
Chronic fascioliasis	1
Colisepticaemia	1
Dystokia	1
Hypocalcaemia	1
Malnutrition	1
PGE - Nematodiriosis	1
Pregnancy toxaemia	1
Ruminal acidosis	1
Salmonellosis -*S* Typhimurium	1
Trauma/Fracture	1

Figure 10 Abortion diagnoses Q1 GB Jan – Mar 2020

The Small Ruminant Species Expert Group monitor cases where a diagnosis does not conform to an existing VIDA code (Diagnosis not listed = 36) the majority of these cases identified bacteria and have included for example *E coli*, *Staphylococcus aureus*, *Streptococcus dysgalactiae, Aeromonas hydrophila* and *Mannheimia haemolytica.*

Syndromic alerts were raised this quarter for the following diseases:

Malnutrition, Mandibular and Dental Abnormalities, Pneumonia *Mannheimia* spp, Fetopathy dt *Chlamydophila abortus.*

Parasitology

Liver Fluke

There have been a small number of cases where chronic liver fluke was diagnosed in sheep during the last quarter with incidences of disease being similar to that seen in 2019. There was a slight increase in the incidence within Scotland when compared to England and Wales, however incidence still at a much lower level than the average for previous years. This is thought to be following on from the exceptionally dry year of 2018 and the dry spring and early summer of 2019.

The map (Figure 11) shows the location in GB chronic fluke has been identified during the first quarter of 2020, with disease seen mainly in the areas of the west of the country and Scotland commonly associated with Liver fluke.

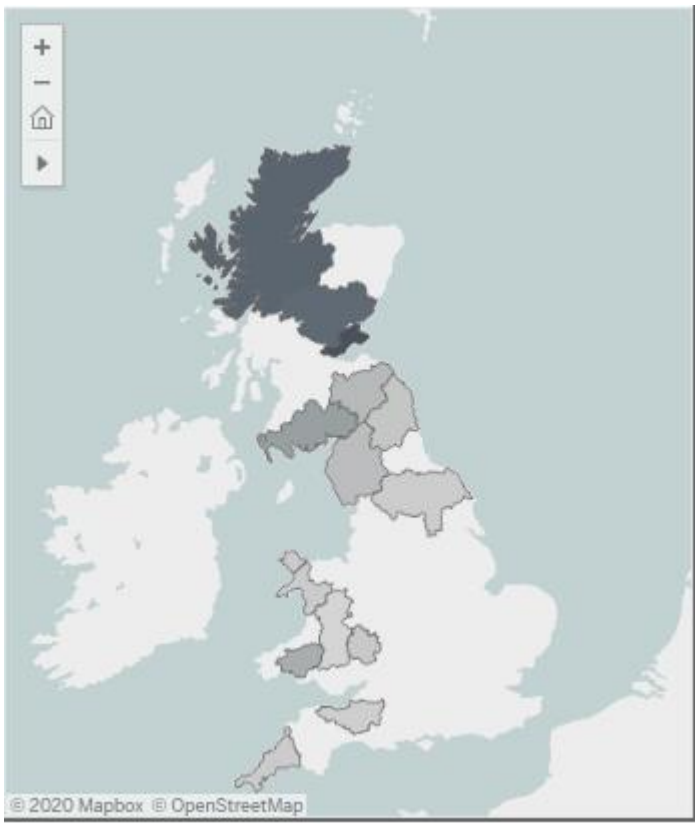

Figure 11 Map of areas where liver fluke was diagnosed during Q1 2020

However it is important that sheep farmers continue to monitor for the presence of active fluke within the adult flock and treat if required. As a single fluke can produce thousands of

eggs daily, which can then multiply within the intermediate snail host to release many thousands of metacercariae onto the pasture. Thus, if climatic conditions are favourable for liver fluke development even small numbers of eggs shed in the spring can result in levels of pasture contamination that will result in disease later in the year.

Tick diseases

There have been particularly early cases of tick borne disease this quarter, likely due to the relatively mild winter weather, with a case of tick borne fever recorded in sheep in north Wales as early as the end of January. In a typical year APHA usually start recording tick borne fever cases from mid-March. Managing tick borne diseases in sheep can be challenging due to a lack of vaccines and limited options for topical treatments. Known infected pastures often have to be carefully managed to allow exposure to the diseases for flock immunity to develop, but without allowing severe signs. The following case was investigated during the middle of February in the southwest of England, and both tick borne fever and Louping Ill were diagnosed:

Multiple tick borne infections were diagnosed in a group of ten-month-old lambs on rented grazing. Approximately 25% of the 100 lamb group were affected with neurological signs including opisthotonus, nystagmus, paddling, recumbency and convulsions one week after they were moved onto new pasture, with a total of fifteen dying. Post mortem findings in three submitted lambs were largely unremarkable. Neurological pathology consisted of an excess of cerebrospinal fluid and congestion of the meninges. A single tick was found on one carcase, this was sent to Public Health England under the Tick Surveillance Scheme and identified as *Ixodes ricinus* species. Louping ill serology was positive, with a predominance of IgM supportive of recent infection. A diagnosis of **louping ill** was confirmed by characteristic changes seen on brain histology. **Tick borne fever** was also detected by PCR in the spleen of one lamb, suggesting concurrent infection and immunosuppression caused by TBF may be contributing to the high morbidity rate of the group.

The rented land grazed by this group was located at the edge of a patch forest on moorland, potentially allowing for large tick numbers, in an ideal environment. Similar clinical signs with equally high morbidity rates had been seen in previous groups of ewes and lambs in this particular field, suggesting the infections were already established in the resident *Ixodes ricinus* tick population. As the field had been rented to multiple farms, the infection levels were likely to remain high with newly infected animals allowing for a greater level of ongoing tick infection.

Metabolic disease

There was an increase in the percentage of diagnosable submissions diagnosed with malnutrition in this quarter (2020 Q1) to 8% compared to Q1 in recent years (2015-2019) where it was 4%. Two examples are detailed below.

Sudden death in ewes on a high dietary proportion of sugar beet

Inappropriate feeding was thought to have resulted in the deaths of eight ewes from a group of 1400 in lamb ewes. They had been split into two groups of 700 and were grazing fodder beet, with movement of the electric fence each day. The flock was due to lamb at the start of March. It was reported that mainly younger ewes were affected, and they were found in sternal recumbency. Silage feeding had been commenced following the first postmortem examination with a single round bale feeder being supplied to each group. The gross postmortem findings were consistent in all three ewes, which were in good to fat body condition. The rumen contents were liquid with limited fibre present, and there were liquid contents throughout the remainder of the alimentary tract. The kidneys were pale. Testing aqueous humour for calcium and magnesium gave normalvalues, and there was evidence of ketosis in one ewe. Increasing the rate of silage feeding, including provision of more feeders to allow better access was advised. Fodder beet has a high moisture content, and concerns were also raised about management of the ewes as they got closer to lambing to prevent twin lamb disease, since those that were submitted could have been considered to be in too good body condition for the stage of production. More advice on brassica feeding can be found in the AHDB link below.

http://beefandlamb.ahdb.org.uk/wp-content/uploads/2018/05/BRP_BrassicaManual_WEB_2018-05-02.pdf

Starvation due to lack of milk in a 24-day-old lamb

A lamb was submitted to investigate sudden death. It was one of twins and the ewe was reportedly healthy. Some ewes were reportedly thinner than optimum, and had been treated with triclabendazole three weeks earlier. At necropsy, the lamb was emaciated, and the rumen contained matted green fibre. The abomasum contained a clump of matted green fibre, and a tiny milk clot. There was minimal content in the intestinal tract. No abnormalities were seen to indicate that the lamb was unable to suckle. The gross appearance was consistent with starvation due to not obtaining enough milk from the dam. It was recommended that the lamb's dam must be checked for body condition and udder lesions such as orf or chronic mastitis. The farmer was advised to record the ewe number in which one lamb in a twin is poor, or has died, so that the body condition score and udder can be carefully checked again at weaning time, or when ewe cull decisions are made.

Reproductive disease

No VIDA diagnoses for fetopathy *Salmonella* Typhimurium or *Coxiella burnetii* were recorded for this first quarter (VIDA Figures). Wales Veterinary Science Centre did diagnose ***Salmonella* Typhimurium** in a ewe and was thought to be associated with abortion in a flock that was vaccinated against EAE and toxoplasmosis. Several ewes aborted, became unwell and then died within a few days. At PME the intestinal contents were liquid and the significant gross findings were an endometritis with dark brown/red fetid material covering the endometrium. Salmonellosis was suspected from clinical history and the PVS was notified. *Salmonella* Typhimurium was cultured from an endometrial

swab and further advice was given to the farmer of the zoonotic risk of handling infected animals.

Salmonellosis due to *S*. Berta in periparturient ewes

A Group D Salmonella identified as *Salmonella* Berta was isolated on aerobic, direct and enriched cultures of tissues from a dead ewe, her aborted lambs and a stillborn lamb from another ewe submitted to APHA Carmarthen VIC. The submitting flock had experienced recent problems with cervical prolapse, abortion and death of three ewes in a flock of 125 pedigree ewes.

Post-mortem examination of the ewe found:

- dark red mucous membranes
- subcutaneous and muscular haemorrhages across the carcase
- serosal haemorrhages over the lung
- lymphadenopathy
- Liquid/watery intestinal content and soft faeces.

Examination of her lambs found varying degrees of autolysis. All three exhibited multifocal petechial/ecchymotic haemorrhages over the lungs, epicardium and subcutaneous tissues. Examination of the stillborn lamb, reported to have been born following dystocia, found partially inflated lungs and was otherwise unremarkable. *Salmonella* Berta was isolated on culture confirming salmonellosis as the cause of the clinical signs seen.

Salmonella Berta is a very rare *Salmonella* within the UK; it has been associated with outbreaks of human disease in Scandinavia and there are some reports of isolation from animals in the Indian subcontinent. The likely source is thus hard to predict although a feed ingredient in a compound ration could be a possibility.

Salmonella Dublin abortion in sheep

Four ovine fetuses and a small piece of placenta were submitted to investigate abortions in 12 ewes from a group of 290 ewes. Aborted ewes had mostly been well although two have been sick and one of these has died. The abortions have occurred in a group that has been away on tack. Both housed and turned out ewes have been affected; both were fed on grass silage and cake and in good body condition. On examination, the fetuses and one piece of placenta were unremarkable apart from autolysis. *Salmonella* Dublin was isolated from foetal stomach content from the three fetuses tested. Typically, when sheep are affected by *Salmonella* Dublin infection, there is a link to cattle such as sheep using housing previously used for cattle. There is no licensed vaccine to control *Salmonella* Dublin infection in sheep in UK. Control relies on good hygienic methods including isolation of aborting ewes and proper disposal of fetuses and placentae. There is some further information here:

Mearns R (2007) Abortion in sheep 2 Other Common and Exotic causes. In Practice 29, 83-90

Abortions due to *Campylobacter* spp.

Following the peak in 2019 the number of abortion submissions diagnosed with *Campylobacter* spp. has shown a significant decline (Figure 12). The number of submissions diagnosed in the 1st quarter with *Campylobacter* decreased from 117 to 55 for this year. Cases of *Campylobacter* spp. abortion in ewes are thought to cyclically increase in frequency every three to five years. The reasons for this are uncertain; however, waning immunity of older ewes, buying-in of naïve animals and climatic conditions may all play a part.

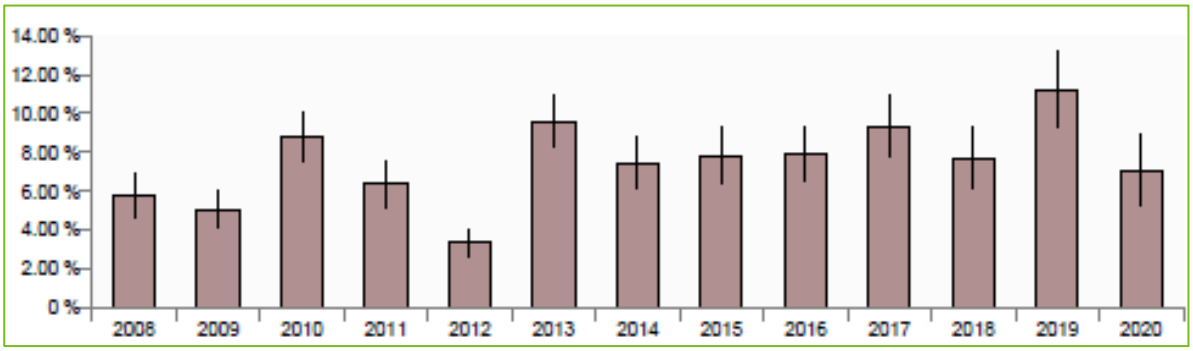

Figure 12 GB Incidents of Campylobacter fetopathy for Q1 as a % of diagnosable submissions 2008-2020

Border Disease

Border disease virus was detected in at least seven submissions submitted to investigate abortions. Additional surveillance was in place until Covid 19 lockdown restrictions curtailed this additional testing (BDV PCR testing on all sheep abortion samples were encouraged for APHA this season). A few of these were diagnosed with other concurrent abortifacients such as EAE and Toxoplasmosis.

Abortion in ewes associated with border disease virus

Four ewes had aborted from this flock of 95 in the previous three days. Affected ewes produced lambs that looked slightly early and some mummification was also reported. No abortion vaccinations were used. Some yearlings were purchased in the last year. At examination, fetuses were moderately or severely autolysed and one was moderately mummified. Thymus or spleen from a fetus from each of two ewes was tested for border disease virus (BDV) by PCR and each was positive. The positive BDV results indicates in utero infection with BDV but does not necessarily confirm this was the cause of abortion. However mummification is a feature of in-utero BDV infection. Further flock level investigations could include blood sampling ewes for BDV antibody and antigen and monitoring this year's lamb crop for "hairy-shaker" signs.

Bovine Viral Diarrhoea Type 1 virus

BVD virus was detected in fetuses submitted to APHA Starcross VIC to investigate abortions in a flock of 700-800 breeding ewes. There had been six abortions in three weeks. The flock was due to start lambing early March. Fetus 1 was aborted from a two tooth ewe and Foetus 2 and 3 were aborted by an older ewe. With the exception of the latter, all abortions had been in two-tooth ewes. This was the first year that the flock had been housed for lambing. They were fed maize and grass silage; concentrate feed was started a week ago. There had been previous diagnoses of listeriosis within the flock as well as some ocular and foot issues. BVD had recently been diagnosed in the herd of cattle on farm which was established approximately three years ago. The cattle did co-graze with the sheep but were housed separately. The two-tooth ewes and ewe lambs had been vaccinated against toxoplasmosis as this had been diagnosed the previous year. The flock was not vaccinated against EAE.

Schmallenberg virus (SBV) infection

No confirmed SBV diagnoses were recorded apart from one case from APHA Starcross VIC where a serology sample from a ewe that had malformed twin lambs tested positive. PCR testing on fetal samples were negative. During Q1 2020 SBV testing was applied in 12 investigations of fetal submissions with gross signs suggestive of SBV for example arthrogryposis or brain pathology (see osteogenesis imperfecta case description). Almost 50% of sheep cases can have cleared the virus by the time they are born. Dam antibodies can give further supportive evidence and should be considered if submitting fetuses where SBV is suspected.

Other diagnosed causes of abortion include E coli, *M haemolytica*, *Aeromonas hydrophila*, *Streptococcus dysgalactiae*, BVDv, *Salmonella* Agama, *Aspergillus fumigatus* and *Yersinia* sp.

Skin disease

Skin Diseases

Sheep scab was the most common skin disease diagnosed in sheep during the first quarter of the year. This disease was diagnosed on 40 submissions, Sheep scab is primarily considered a winter disease with most cases occurring between October and April. Pruritus, wool loss and extensive crusting lesions on the skin were the more common lesions reported.

Suspected Moxidectin resistance in *Psoroptes* sp. mites in North of England

Skin and wool samples were submitted to the APHA laboratories to investigate suspected sheep scab treatment failure. From a single group of 23 sheep, skin disease and wasting was reported to be affecting all the animals despite treatment with a moxidectin-based endectocide. Live *Psoroptes* sp. mites were detected in four of the six samples submitted.

Moxidectin resistance was strongly suspected in *Psoroptes* sp. mites using an *in-vitro* test that is under validation which showed a high survival rate of the submitted mites in the presence of moxidectin compared to known susceptible control mites. Moxidectin resistance in *Psoroptes ovis* mites has been confirmed in England and Wales since 2018 (Doherty and others 2018) and resistance to all three available macrocyclic lactones compounds in populations of *Psoroptes* mites was demonstrated in the UK in 2019. To date, most of the resistant *P. ovis* populations were reported in Wales and English counties adjacent to the Welsh border.

APHA is keen to investigate cases of flocks that do not appear to be responding to macrocyclic lactones treatment for sheep scab to determine how widespread resistance is and if you have suspicions please contact the nearest VIC. Fortunately the poor off-host survival of *P. ovis* mites means that, if resistant mites are detected, it should be possible to eradicate them from a flock by dipping effectively in organophosphate.

An outbreak of Infectious keratoconjunctivitis

An outbreak of Infectious keratoconjunctivitis (IKC) was diagnosed in a pedigree flock of Texel ewes. *Mycoplasma conjunctivae*, which is the considered the principal aetiological agent of IKC, was detected by molecular method on pooled eye swabs confirming the diagnosis. Infectious keratoconjunctivitis (IKC) is a common contagious ocular disease among ruminants. In small ruminants, IKC is usually bilateral and produces ocular discharge, epiphora, mild conjunctivitis and/or corneal opacity, causing transitory blindness in most of the cases. However, IKC outbreaks may occur with more severe clinical signs, including affection of the cornea leading to ulceration and perforation of the eye if no treatment is applied. In sheep IKC is encountered most commonly as flock outbreaks in trough-fed and housed ewes in autumn and winter, but occasionally also at other times of the year. Outbreaks of IKC may be triggered by tight stocking and close head to head and eye to eye contact between sheep at troughs and feeders, and infection appears to spread both by direct contact and also indirect, for example by contamination of stalks of forage between one animal and the next at feeders and on shepherds' overalls. Outbreaks tend to be prolonged if different groups of sheep are constantly mixed together, resulting in reinfection and fresh outbreaks of disease. It is therefore advisable to keep affected groups of sheep intact, avoid mixing of animals and wear separate overalls when moving from affected to unaffected groups.

Clinical experience suggests that outbreaks of IKC are very frustrating to control in sheep flocks. Close observation of the flock is important in detecting and treating early cases. Local or systemic antibiotic treatment is usually effective in ameliorating the clinical signs but relapses are common.

Successful clinical resolution of experimental *M. conjunctivae* infection has been reported with intramuscular long-acting oxytetracycline treatment and is effective in some field outbreaks. However, medication does not eliminate the organism and repeat treatments are often necessary; outbreaks often last 4 to 6 weeks before complete clinical resolution is seen. Carriage of *M. conjunctivae* for up to 23 weeks has been reported in experimental

infections. Subclinically-infected carrier animals often appear to be the means whereby *M. conjunctivae* is introduced into previously uninfected flocks and after an initial outbreak flocks may succumb to further outbreaks of disease in subsequent years. The susceptibility to disease and the severity of the clinical signs often appears to be greater in adult sheep than young lambs.

Respiratory disease

During this quarter there were increased diagnoses of *Mannheimia* pneumonia, with the increase in cases occurring in preweaned lambs. There has been a gradual increasing trend in quarter 1 *Mannheimia* pneumonia diagnoses in England and Wales since 2017 (Figure 13). In 2019 APHA also identified a sustained increase in the number of cases into quarter 2 of that year. Factors that can predispose young preweaned lambs to *Mannheimia* pneumonia include changeable weather conditions, poor milk supply from the ewe and concurrent infections such as coccidiosis and *Nematodirus* worms. Vaccination of ewes to provide protection to the lambs via the colostrum can help reduce the levels of disease and losses, although the protection is dependent on adequate colostral intake by the lamb and the quality of the colostrum produced by the ewe. Vaccination of the lambs is sometimes necessary to adequately control the problem.

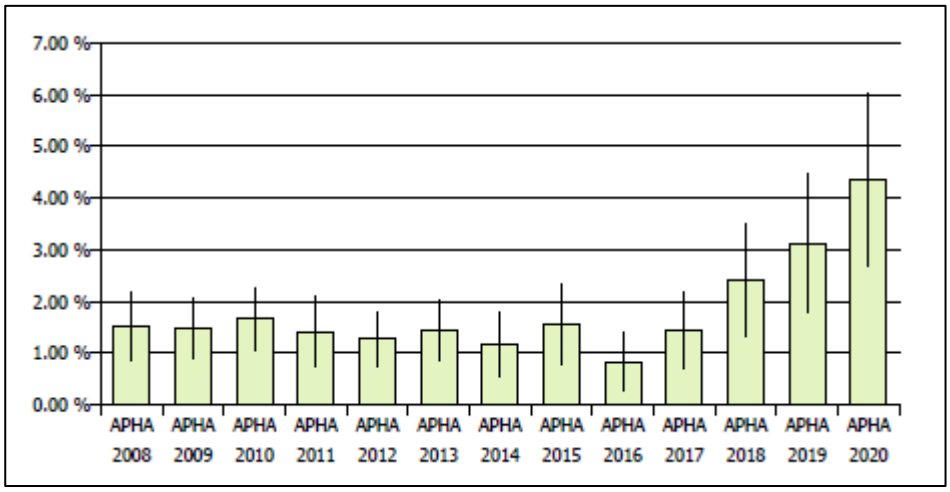

Figure 13 Incidents of *Mannheimia haemolytica* in Sheep as % of diagnosable submissions in Quarter 1 diagnosed by APHA

Urinary disease, Systemic disease, Enteric disease, Nervous disease, Musculoskeletal disease – No significant trends were identified this Quarter.

Centre of Expertise for Extensively Managed Livestock

During Q1 2020 there were 365 submissions from Hill/Upland sheep in GB and the top ten VIDA diagnoses made for these are shown in Figure 14.

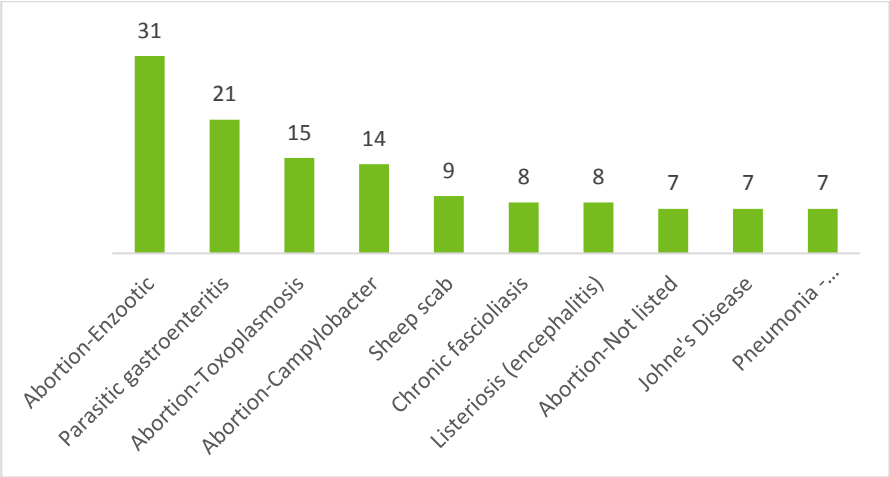

Figure 14 Top 10 GB VIDA diagnoses for Hill/Upland sheep Jan - Mar 2020

A map showing were submissions were received from is shown in Figure 15 . It is worth noting that the purpose of the sheep might be defined as Hill/upland by the submitting vet but does not necessarily mean they are kept in extensively managed situations.

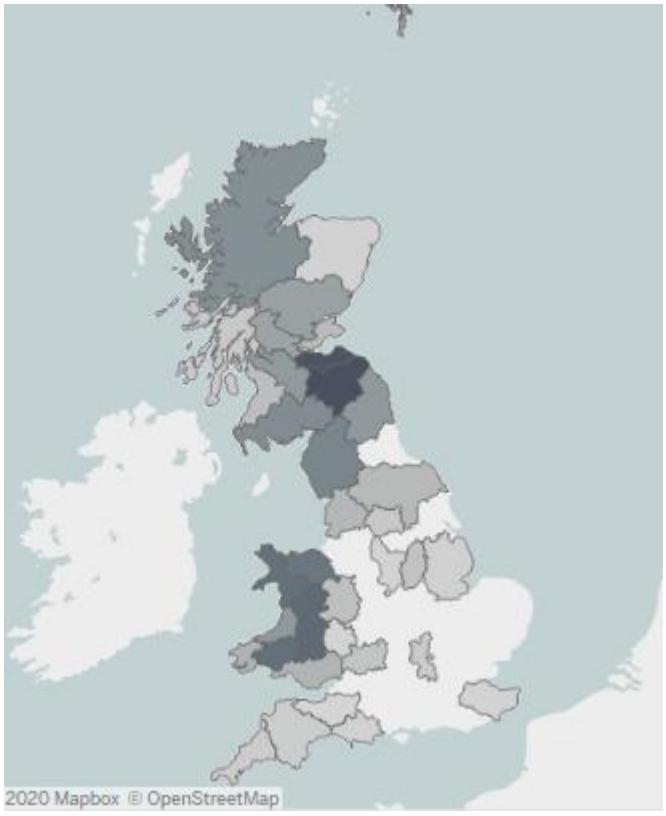

Figure 15 Map showing where submissions received from for sheep – purpose Hill/upland

Horizon scanning

Bluetongue (BTV) update

The risk of introduction of BTV remains low.

For more information, see the updated situation assessment, at:
https://www.gov.uk/government/publications/bluetongue-virus-in-europe

In April, there were 2 outbreaks of BTV in Greece (BTV-4 in sheep, and BTV-16 in cattle). There were no other reports elsewhere.

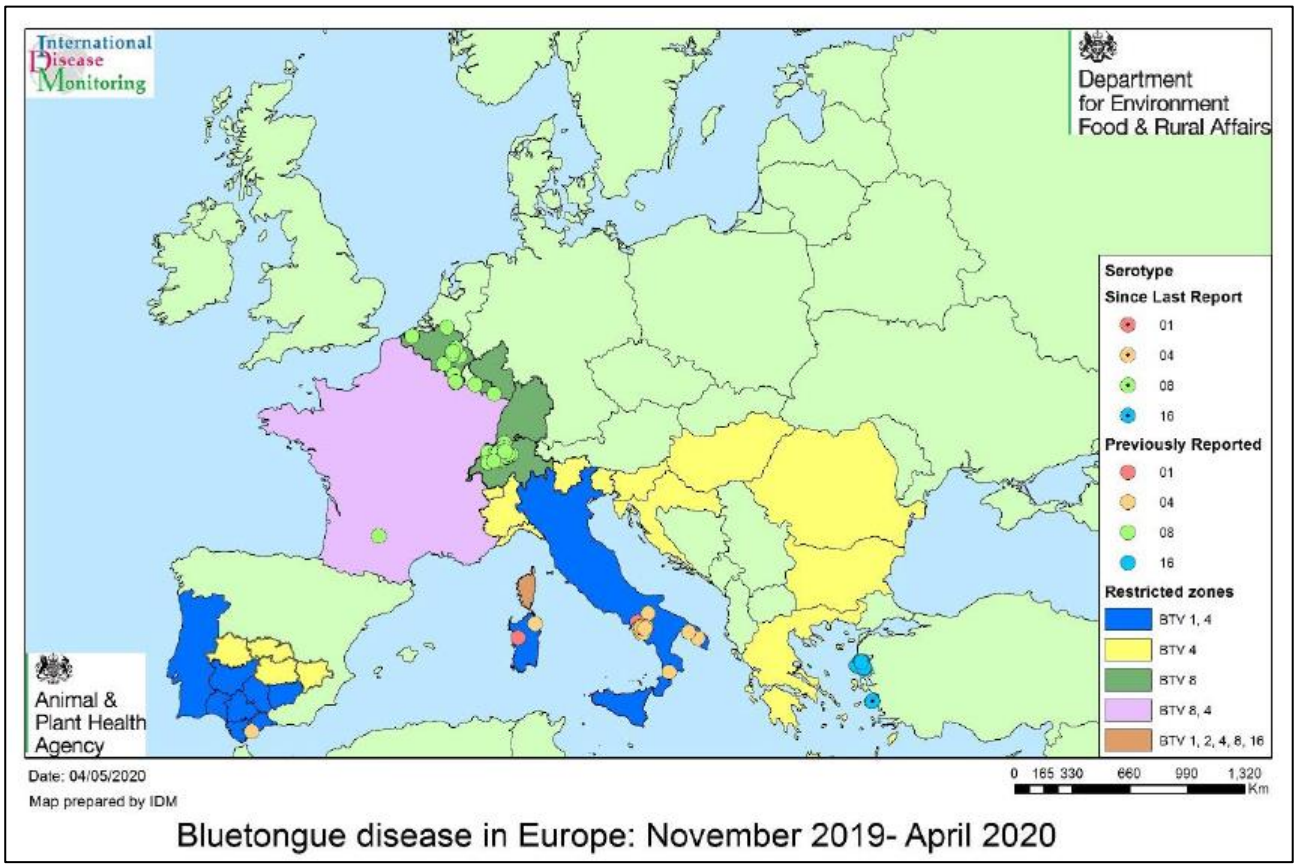

Figure 16 Bluetongue disease in Europe November 2019 – April 2020

AMR related

The European Medicines Agency (EMA) is involved in monitoring and evaluating the risks of using antibiotics in animals. It has looked in particular at the risk of the development of antimicrobial resistance in animals and of the possible transmission of resistance to humans. New scientific advice was issued in January 2020 by the EMA on risk categorisation of antibiotics for use in animals.

The updated categorisation includes new classes of antibiotics and takes account of the need to use antibiotics in animals versus the risk of antimicrobial resistance to public health.

There are **four categories of antibiotics**:

- Category A ('Avoid') includes antibiotics currently not authorised for veterinary use. These medicines cannot be used in food-producing animals and should only be given to pets under exceptional circumstances;

- Category B ('Restrict') refers to quinolones, third- and fourth-generation cephalosporins and polymyxins. These are critically important in human medicine and their use in animals should be restricted;
- Category C ('Caution') covers antibiotics for which alternatives for human use generally exist, but only few alternatives are available in certain veterinary indications. They should only be used when there are no suitable antibiotics in category D;
- Category D ('Prudence') covers antibiotics that may be used in animals in a prudent manner. Group treatment should be restricted to situations where individual treatment is not feasible.

An infographic has been produced which aims to support veterinarians in their choice of antibiotic.
https://www.ema.europa.eu/en/documents/report/categorisation-antibiotics-use-animals-prudent-responsible-use_en.pdf

The Salmonella in Livestock Production in GB 2018 has been published on GOV.UK

https://www.gov.uk/government/publications/salmonella-in-livestock-production-in-great-britain

Poisoning

The latest Chemical Food Safety report can be found at this link:
https://www.gov.uk/government/publications/chemical-food-safety-reports

Copper toxicity

Copper toxicity was diagnosed as the cause of death of an adult Texel pregnant ewe from a ewe flock of 350 mixed breed ewes. Two ewes died but only one death was investigated.

Copper boluses had been administered to the ewes three weeks prior to the deaths as there was a history of swayback on the farm. Post mortem revealed discoloured red urine, dark kidneys and an orange/brown friable liver parenchyma. The gross findings were considered consistent with chronic copper poisoning as a result of a haemolytic crisis and this was confirmed following analysis.

Test	Ref Range	Units	Analytical Results
Copper Kidney	0 - 787	mol/kg DM	8000
Copper Liver	314 - 7850		34600

The liver copper concentration is equivalent to 639.3 mg/kg WM.

As breeding stock, the ewes were not intended to enter the food chain in the near future and so there was no immediate risk to the food chain. APHA advised the PVS and farmer to reassess the ongoing flock requirements for supplementary copper by monitoring their

copper status prior to supplementing. Also to check the current concentrates being fed to ensure that the copper concentrations were suitable for pregnant ewes.

Dumped waste materials

A member of the public raised concerns with APHA regarding a small group of sheep that were grazing in a field where there appeared to be a lot of dumped waste materials including possible asbestos roofing sheets. A preliminary investigation was carried out by APHA field veterinary officers to review the welfare situation of the flock and also assess whether there were likely to be food safety concerns. These issues were ruled out and the investigation passed over to the Local Authorities.

Plant poisonings

Laurel was found to have caused the death of 4 gimmers from a group of 9 affected animals that had strayed into a garden. Clinical signs included teeth grinding with excess salivation and kicking at their abdomens which progressed in some, culminating in ataxia, recumbency and death. A large number of leaf fragments, identified as cherry laurel were found in the rumen of a submitted lamb. Ingestion results in the formation of hydrocyanic acid and the release of cyanide into the blood stream binds with iron in cellular cytochrome oxidase thereby blocking cellular respiration and preventing the release of oxygen. Carcases may appear cherry red if examined early due supersaturation of erythrocytes with oxyhaemoglobin and have a smell of bitter almonds.

Eight lambs from a small flock of lambs had died as a result of yew poisoning. Exposure was confirmed at post mortem as their rumens were full of yew needles. It was considered that clippings had been dumped in the field. Yew contains taxine alkaloids which are a mixture of cardio toxins that can induce fatal conductive disturbances with direct action on cardiac myocyte ion channels.

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